

## APRIL, 1912, LAKE LEVELS.

The following data are from the report of the United States Lake Survey office.

Lakes.	Above tide water, New York.
	<i>Feet.</i>
Superior.....	601.46
Michigan-Huron.....	579.44
Erie.....	572.25
Ontario.....	246.32

Lake Superior is 0.07 foot higher than last month, 0.92 foot higher than a year ago, 0.31 foot below the average stage of April for the last 10 years, 1.23 feet below the high stage of April, 1860, and 0.92 foot above the low stage of April, 1911. It will probably rise 0.3 foot during May.

Lakes Michigan and Huron are 0.17 foot higher than last month, 0.03 foot higher than a year ago, 1.00 foot below the average stage of April for the last 10 years, 3.79 feet below the high stage of April, 1886, and 0.22 foot above the low stage of April, 1896. They will probably rise 0.3 foot during May.

Lake Erie is 1.06 feet higher than last month, 0.64 foot higher than a year ago, 0.09 foot lower than the average stage of April for the last 10 years, 1.93 feet below the high stage of April, 1862, and 0.99 foot above the low stage of April, 1895. It will probably rise 0.4 foot during May.

Lake Ontario is 1.22 feet higher than last month, 0.88 foot higher than a year ago, 0.05 foot lower than the average stage of April for the last 10 years, 2.11 feet below the high stage of April, 1886, and 1.48 feet above the low stage of April, 1872. It will probably rise 0.3 foot during May.

## FLOODS IN MICHIGAN, SPRING OF 1912.

By C. F. SCHNEIDER, Section Director.

The high water in the Grand River in the spring of 1912 was caused entirely by the melting and run-off of the winter's accumulation of snow and of ice formed in the snow by frozen rain. During the entire period of the melting and run-off, there was less than one-third of an inch of rain on an average throughout the watershed and the melting was caused entirely by the advance of the season.

During January, February, and the first two decades of March, the weather was very severe and the entire period was devoid of any decided thaw, such as usually occurs during January or February. The result was that at the end of the second decade of March, all of the snowfall of the winter was stored on the ground, which was frosted to a depth of several feet.

About the middle of February there seemed to be an indication that there might be a general thaw which would release some of the water held in storage and a very careful and extensive survey of the amount of snow and ice on the ground and its water content was made. Postal cards asking for the information were sent to every post office in the watershed and the returns charted, showing that there was an average of from 11 to 15 inches of snow on the ground, which would yield about 3½ inches of water if the thaw were decided enough. The weather, however, remained too cold to melt any of the snow sufficiently to allow it to run into the river or its tributaries.

On March 7 another survey of the amount of water stored on the ground was made in a similar manner, and it was found that the depth had increased somewhat over the upper stretches of the river. At this time warning was issued to the public, saying that the season had advanced so far without any run-off at all that unless a very slow thaw immediately set in, at least 15 feet of water could be expected at Grand Rapids by the close of the month or soon thereafter. Merchants, factories, and other concerns were advised to take precautionary steps to protect themselves from a water stage that would almost surely reach 15 feet.

The mean temperature rose above freezing on the 17th for a few days, but fell below that point on the 20th and continued so until the 26th. The day temperatures, however, softened the snow so that on the 26th of March, when the mean temperature rose above the freezing point permanently, the congestion of water began in earnest.

The first flood warning was issued March 22, and warnings were sent out from day to day thereafter until the flood subsided. The river rose steadily during the last few days of March, reaching flood stages at Grand Rapids on April 2 and the highest point, 15.8, on April 7.

In the meantime, one ice gorge after another formed both above and below the city of Portland and caused the citizens of that place much discomfort and anxiety, but the Portland ice gorges were the only serious ones which occurred throughout the entire river stand. The river fell below flood stage at Eaton Rapids on April 2; at Lansing, April 9; at Grand Ledge, April 10; Iona, April 9; Lowell, April 11; and at Grand Rapids, April 13. At the close of the month, the river stages at all places were above normal.

The flood in the Saginaw River is interesting in that it was caused entirely by the run-off of the winter's accumulation of snow.

On March 12, after making a careful survey of the snow on the ground and owing to the lateness of the season, a statement was issued from the Grand Rapids office of the Weather Bureau to the citizens of the Saginaw Valley, saying that there was more than a probability that high water would prevail during the last of March or the early part of April; if there was no heavy rain, the water would rise only to a moderate height above flood stages, but that with rain more severe conditions might be expected. During the flood there was some ice jamming, but aside from alarming the people and causing slight temporary rises, no appreciable effect was traceable to jams.

The warm weather which set in during the last decade of March caused rapid rises in most of the tributaries of the Saginaw River and the waters then congested in that short stream.

Flood warnings were issued to all places in the lower part of the Saginaw watershed on March 22 and flood stages were reached at Midland and Saginaw by the close of the month.

The greatest damage was done at Midland and Saginaw. At Midland the river rose 4.5 feet above flood stage on April 1 and then fell slowly until the evening of the 4th, when two days of very warm weather occurred that searched out all of the remaining snow in the woods and gullies, again raising the river until the evening of April 6, when it was 5.5 feet above flood stage. At this time, a large section of the city of Midland was under water and many of the residents in one part of the town were driven from their homes.

At Saginaw the river reached a stage of 21.8 feet, or 2.7 feet above flood stage on the morning of April 3 and then remained nearly stationary until the 5th, when a steady rise set in that finally reached its highest point of 23.3 feet on the morning of April 8. The river did not begin to fall until during the day of April 9, after which it receded slowly and fell below flood stage by the morning of April 17.

Altogether, the river was above flood stage at Midland 11 days and at Saginaw nearly 16 days. The damage at Saginaw, on account of its greater population, was considerable. Many of the large factories along the river were shut down, while from 2 to 4 feet of water stood in the basements of a large number of the business houses in the retail district and the heart of the city.

The flood would have been much more severe had moderately heavy rains occurred while the water was rising or had a sudden downpour occurred while the flood was at its height.

The warnings of the Weather Bureau at Saginaw were an entirely new feature to the people of that city and much praise was given by citizens and by the press for the timely and accurate warnings, and for the general information which was published in the newspapers from day to day regarding the condition of all the tributaries above. The Weather Bureau and the public are greatly indebted to the Saginaw Courier-Herald, a morning paper, and the Saginaw Daily News, an evening paper, for publishing all warnings and gage readings without expense to the United States.